OPAL-RT

# OP4500 RT-LAB-RCP/HIL SYSTEM USER GUIDE

**Published by**

OPAL-RT Technologies, Inc. 1751 Richardson, suite 2525 Montréal (Québec) Canada H3K 1G6

www.opal-rt.com

© 2013 OPAL-RT Technologies, Inc. All rights reserved
Printed in Canada

# SYMBOL DEFINITIONS

The following table lists the symbols used in this document to denote certain conditions:

| Symbol | Definition |
|---|---|
| | ATTENTION: Identifies information that requires special consideration |
| | TIP: Identifies advice or hints for the user, often in terms of performing a task |
| | REFERENCE _ INTERNAL: Identifies an additional source of information within the bookset. |
| **CAUTION** | Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process. |
| | Indicates a situation where users must observe precautions for handling electrostatic sensitive devices. |
| | CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. |
| | WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death. |

# CONTENTS

**INTRODUCTION ..... 7**
FEATURES ..... 8
FRONT INTERFACE ..... 9
REAR INTERFACE ..... 10
DB37 PIN ASSIGNMENTS (GENERAL) ..... 11
DB37 Analog Output ..... 11
DB37 Analog Input ..... 11
DB37 Digital Output ..... 12
DB37 Digital Input ..... 13
DB9 PIN ASSIGNMENTS (GENERAL) ..... 14
OP4500 SIMULATOR SPECIFICATIONS ..... 15
ON BOARD I/O SPECIFICATIONS ..... 16
32 Digital In ..... 16
32 Digital Out ..... 16
RS422 Digital In ..... 16
RS422 Digital Out ..... 16
**OP4500 SERIES PIN ASSIGNMENTS ..... 17**
OP4500 SERIES 100 FOR MECHATRONICS ..... 17
SERIES 200 FOR RCP ..... 24
OP4500 SERIES 300 AND 400 FOR POWER ELECTRONICS ..... 31
**LIMITED WARRANTY ..... 39**
LIMITED WARRANTY ..... 39
RETURN POLICY ..... 39
EXCLUSIONS ..... 39
WARRANTY LIMITATION AND EXCLUSION ..... 40
DISCLAIMER OF UNSTATED WARRANTIES ..... 40
LIMITATION OF LIABILITY ..... 40

# INTRODUCTION

The OP4500 is a compact device with 96 fast I/O channels with signal conditioning, fast 5-Gbits fiber optics and is fully integrated with Simulink, SimPowerSystem. The integration of high-end INTEL multi-core processors with powerful XILINX Kintex 7 FPGA allows greater simulation power and sub-microsecond simulation time steps to maximize accuracy of fast power electronic systems. The OP4500 can simulate power grids with up to about 200 nodes.

A series of standardized I/O configurations are available with the OP4500, each targeting specific fields:

- Series 100 - RCP/HIL. Simulink models run on CPU and I/O managed by the FPGA
- Series 200 - RCP/HIL for Power Electronic systems simulated on the CPU
- Series 300 - RCP/HIL for fast Power Electronic system simulation on FPGA using eHS
- Series 400 - RCP/HIL for Power Grids simulation

The OP4500 is an entry-level simulator that contains an FPGA carrier, which can accept two standard OPAL-RT mezzanine boards, in addition to the onboard digital and differential signals (see image below).

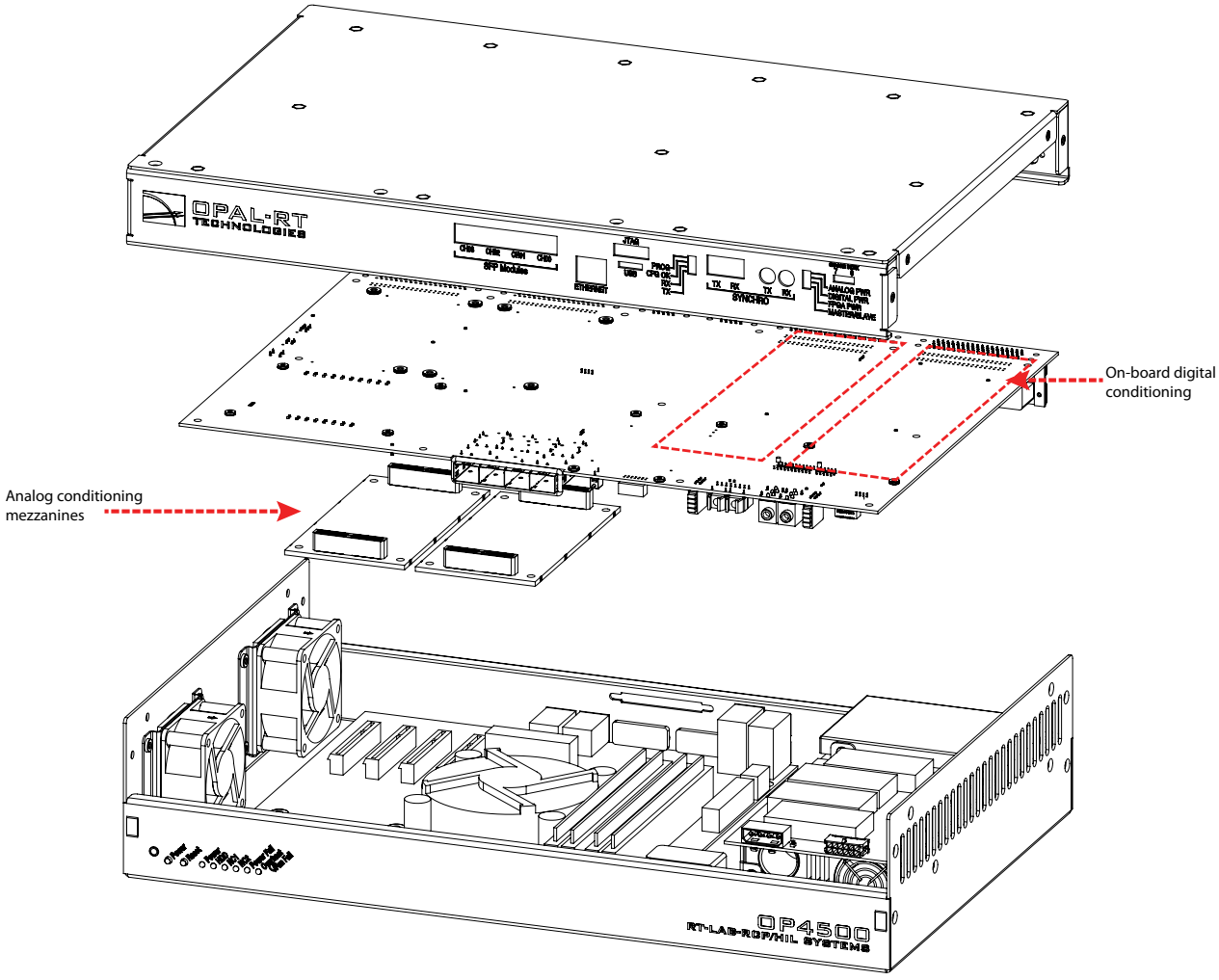



Figure 1: OP4500 architecture

The mezzanine slots can accept either 16 analog inputs or outputs, depending on the type of mezzanine boards selected. These mezzanine boards use a DB37 connector.

Analog and digital signals use a DB37 connector and RS422 differential signals use a DB9 connector.

The OP4500 offers two types of synchronisation, either LVDS or fiber optic, making it easier to synchronize with any OPAL-RT device.

## FEATURES

- Status LEDs
- Target status LEDs
- DB37 connectors
- DB9 connectors

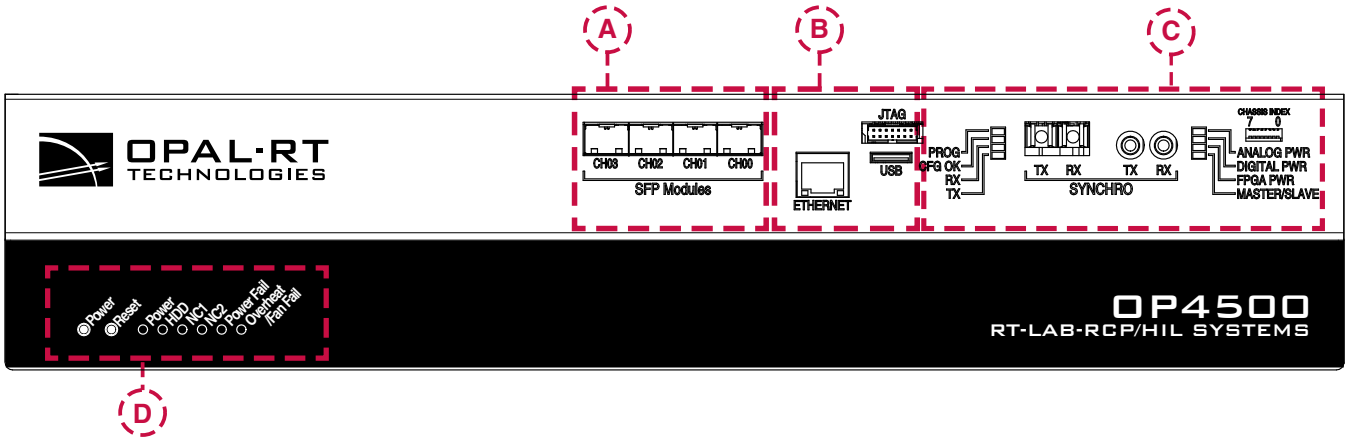
Digital Output Channels:

- 32 Dout on two DB37F connector (Channel 00 to 15 and 16 to 31)
- 5 V to 15 V, 50 mA max, individual channel protection with Resettable Fuse
- Galvanic isolation, Vuser from 5 V min to 15 V max

Digital Input Channels:

- 32 Din on two DB37F connector (Channel 0 to 31)
- 4 V to 30 V, 3.6 mA min,
- 40 nanosecond typical propagation delay
- Opto-coupler isolation, Vinput from 4 V min to 30 V max

# FRONT INTERFACE



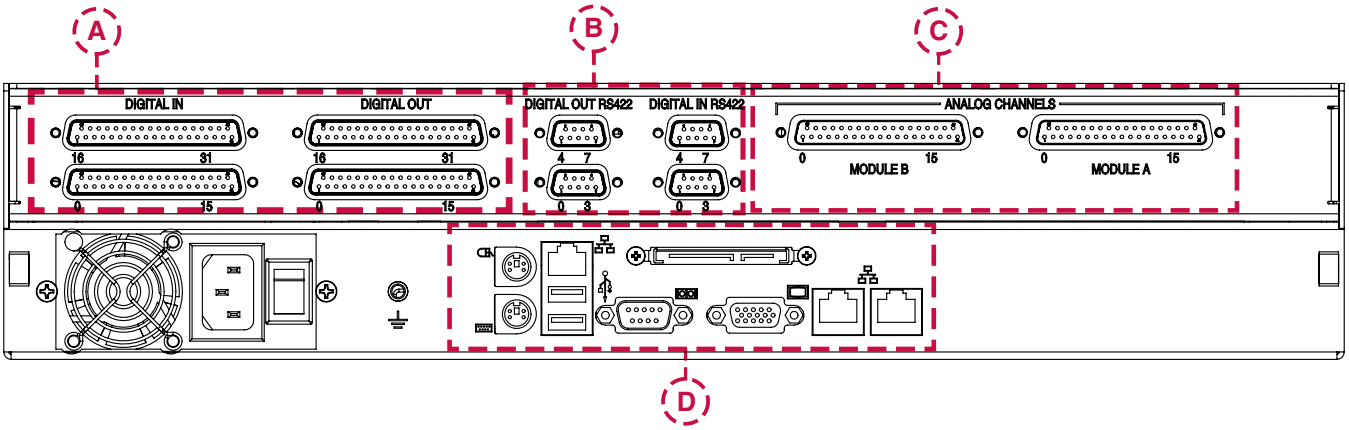

A. Small Form-factor pluggable (SFP) module connectors (*not available - reserved for future use*).
B. JTAG, USB and ETHERNET connectors (USB and ETHERNET are *not available - reserved for future use*)
C. Synchronization connectors and status LEDs:

| | |
|---|---|
| **PROG:** | Lights on setup (for technicians's use only) |
| **CFG OK:** | Lights on setup (for technicians's use only) |
| **RX:** | Green when receiving synchronization |
| **TX :** | Green when transmitting synchronization |
| **ANALOG PWR:** | Green to indicate analog power is functioning |
| **DIGITAL PWR:** | Green to indicate digital power is functioning |
| **FPGA PWR:** | Green to indicate FPGA power is functioning |
| **MASTER/SLAVE: .** | Green indicates MASTER mode, Yellow indicates SLAVE mode |
| **CHASSIS INDEX:** | 8-pin DIP switch that allows users to set the device's network chassis index. It can be set from 00 to FF (in HEX) for a maximum of 256 addresses. |

D. Target computer monitoring interface. Two push buttons include POWER in top position to power on or shut down the Target computer and RESET, in the bottom position, to reset the target computer. There are 6 LED indicators:

| LED | NAME | Description |
|---|---|---|
| Green | Power | On indicates that the unit is powered up. |
| Green | HDD | On indicates that the hard disk drive is operating. |
| Green | NIC1 | On indicates that network port 1 is in use. |
| Green | NIC2 | On indicates that network port 2 is in use. |
| Red | Power Fail | On indicates a power fault. |
| Red | Overheat/Fan Fail | On indicates either that unit has overheated or a fan fault. |

# REAR INTERFACE




A. DB37 connectors for digital inputs and outputs.
B. DB9 connectors for RS422 differential signal inputs and outputs.
C. DB37 connectors for analog inputs and outputs.
D. Standard computer connectors (left to right): mouse and keyboard, USB ports, monitor, network ports* and (above monitor connectors) a SATA connector to provide access to the OP4500 hard drive.

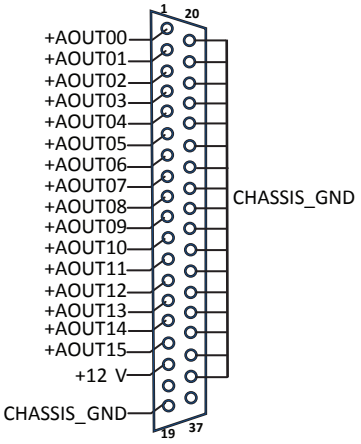
*Note that only one network port is required for network connection; use of other connectors is optional.

# DB37 PIN ASSIGNMENTS (GENERAL)

The following table provides the generic pin assignments for the OP4500's DB37 connectors. More detailed information, tailored to specific firmware, can be found in "OP4500 Series Pin Assignments".

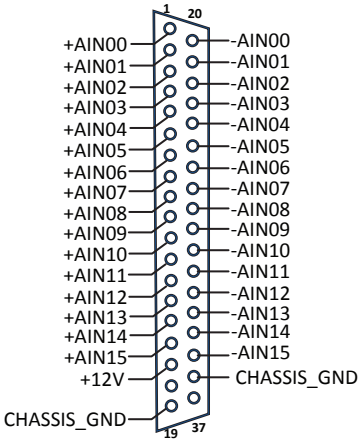
## DB37 Analog Output

| DB37 | OP4500 pin assignment | DB37 | OP4500 pin assignment |
|---|---|---|---|
| 1 | +AOUT00 | 20 | CHASSIS_GND |
| 2 | +AOUT01 | 21 | CHASSIS_GND |
| 3 | +AOUT02 | 22 | CHASSIS_GND |
| 4 | +AOUT03 | 23 | CHASSIS_GND |
| 5 | +AOUT04 | 24 | CHASSIS_GND |
| 6 | +AOUT05 | 25 | CHASSIS_GND |
| 7 | +AOUT06 | 26 | CHASSIS_GND |
| 7 | +AOUT07 | 27 | CHASSIS_GND |
| 9 | +AOUT08 | 28 | CHASSIS_GND |
| 10 | +AOUT09 | 29 | CHASSIS_GND |
| 11 | +AOUT10 | 30 | CHASSIS_GND |
| 12 | +AOUT11 | 31 | CHASSIS_GND |
| 13 | +AOUT12 | 32 | CHASSIS_GND |
| 14 | +AOUT13 | 33 | CHASSIS_GND |
| 15 | +AOUT14 | 34 | CHASSIS_GND |
| 16 | +AOUT15 | 35 | CHASSIS_GND |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |




## DB37 Analog Input

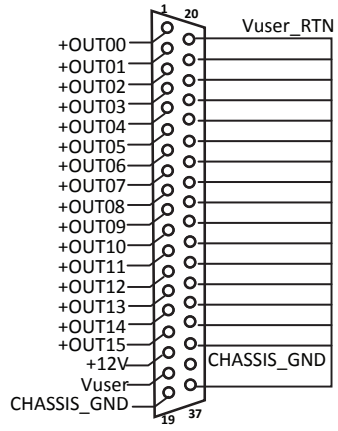
| DB37 | OP4500 pin assignment | DB37 | OP4500 pin assignment |
|---|---|---|---|
| 1 | +AIN00 | 20 | -AIN00 |
| 2 | +AIN01 | 21 | -AIN01 |
| 3 | +AIN02 | 22 | -AIN02 |
| 4 | +AIN03 | 23 | -AIN03 |
| 5 | +AIN04 | 24 | -AIN04 |
| 6 | +AIN05 | 25 | -AIN05 |
| 7 | +AIN06 | 26 | -AIN06 |
| 7 | +AIN07 | 27 | -AIN07 |
| 9 | +AIN08 | 28 | -AIN08 |
| 10 | +AIN09 | 29 | -AIN09 |
| 11 | +AIN10 | 30 | -AIN10 |
| 12 | +AIN11 | 31 | -AIN11 |
| 13 | +AIN12 | 32 | -AIN12 |
| 14 | +AIN13 | 33 | -AIN13 |
| 15 | +AIN14 | 34 | -AIN14 |
| 16 | +AIN15 | 35 | -AIN15 |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



## DB37 Digital Output

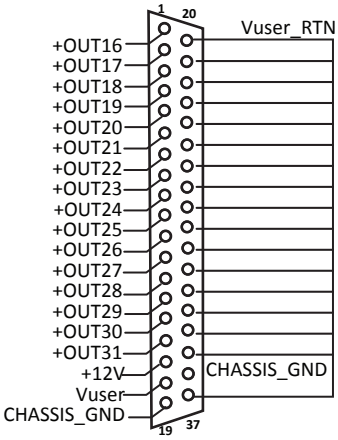
**Connector 0-15**

| DB37 | OP4500 pin assignment | DB37 | OP4500 pin assignment |
|---|---|---|---|
| 1 | +OUT00 | 20 | Vuser_RTN |
| 2 | +OUT01 | 21 | Vuser_RTN |
| 3 | +OUT02 | 22 | Vuser_RTN |
| 4 | +OUT03 | 23 | Vuser_RTN |
| 5 | +OUT04 | 24 | Vuser_RTN |
| 6 | +OUT05 | 25 | Vuser_RTN |
| 7 | +OUT06 | 26 | Vuser_RTN |
| 7 | +OUT07 | 27 | Vuser_RTN |
| 9 | +OUT08 | 28 | Vuser_RTN |
| 10 | +OUT09 | 29 | Vuser_RTN |
| 11 | +OUT10 | 30 | Vuser_RTN |
| 12 | +OUT11 | 31 | Vuser_RTN |
| 13 | +OUT12 | 32 | Vuser_RTN |
| 14 | +OUT13 | 33 | Vuser_RTN |
| 15 | +OUT14 | 34 | Vuser_RTN |
| 16 | +OUT15 | 35 | Vuser_RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |




**Connector 16-31**

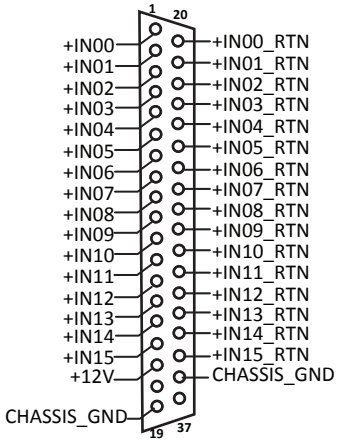
| DB37 | OP4500 pin assignment | DB37 | OP4500 pin assignment |
|---|---|---|---|
| 1 | +OUT16 | 20 | Vuser_RTN |
| 2 | +OUT17 | 21 | Vuser_RTN |
| 3 | +OUT08 | 22 | Vuser_RTN |
| 4 | +OUT19 | 23 | Vuser_RTN |
| 5 | +OUT20 | 24 | Vuser_RTN |
| 6 | +OUT21 | 25 | Vuser_RTN |
| 7 | +OUT22 | 26 | Vuser_RTN |
| 7 | +OUT23 | 27 | Vuser_RTN |
| 9 | +OUT24 | 28 | Vuser_RTN |
| 10 | +OUT25 | 29 | Vuser_RTN |
| 11 | +OUT26 | 30 | Vuser_RTN |
| 12 | +OUT27 | 31 | Vuser_RTN |
| 13 | +OUT28 | 32 | Vuser_RTN |
| 14 | +OUT29 | 33 | Vuser_RTN |
| 15 | +OUT30 | 34 | Vuser_RTN |
| 16 | +OUT31 | 35 | Vuser_RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



## DB37 Digital Input

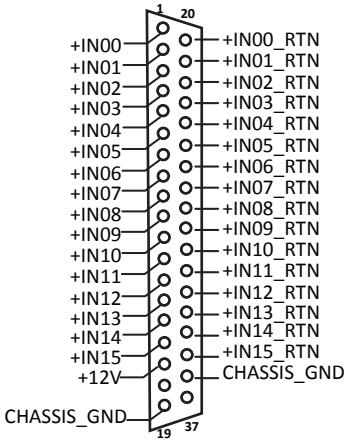
**Connector 0-15**

| DB37 | OP4500 pin assignment | DB37 | OP4500 pin assignment |
|---|---|---|---|
| 1 | +IN00 | 20 | +IN00_RTN |
| 2 | +IN01 | 21 | +IN01_RTN |
| 3 | +IN02 | 22 | +IN02_RTN |
| 4 | +IN03 | 23 | +IN03_RTN |
| 5 | +IN04 | 24 | +IN04_RTN |
| 6 | +IN05 | 25 | +IN05_RTN |
| 7 | +IN06 | 26 | +IN06_RTN |
| 7 | +IN07 | 27 | +IN07_RTN |
| 9 | +IN08 | 28 | +IN08_RTN |
| 10 | +IN09 | 29 | +IN09_RTN |
| 11 | +IN10 | 30 | +IN10_RTN |
| 12 | +IN11 | 31 | +IN11_RTN |
| 13 | +IN12 | 32 | +IN12_RTN |
| 14 | +IN13 | 33 | +IN13_RTN |
| 15 | +IN14 | 34 | +IN14_RTN |
| 16 | +IN15 | 35 | +IN15_RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |




**Connector 16-31**

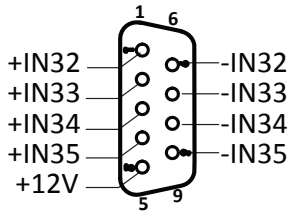
| DB37 | OP4500 pin assignment | DB37 | OP4500 pin assignment |
|---|---|---|---|
| 1 | +IN16 | 20 | +IN16_RTN |
| 2 | +IN17 | 21 | +IN17_RTN |
| 3 | +IN08 | 22 | +IN18_RTN |
| 4 | +IN19 | 23 | +IN19_RTN |
| 5 | +IN20 | 24 | +IN20_RTN |
| 6 | +IN21 | 25 | +IN21_RTN |
| 7 | +IN22 | 26 | +IN22_RTN |
| 7 | +IN23 | 27 | +IN23_RTN |
| 9 | +IN24 | 28 | +IN24_RTN |
| 10 | +IN25 | 29 | +IN25_RTN |
| 11 | +IN26 | 30 | +IN26_RTN |
| 12 | +IN27 | 31 | +IN27_RTN |
| 13 | +IN28 | 32 | +IN28_RTN |
| 14 | +IN29 | 33 | +IN29_RTN |
| 15 | +IN30 | 34 | +IN30_RTN |
| 16 | +IN31 | 35 | +IN31_RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



# DB9 PIN ASSIGNMENTS (GENERAL)

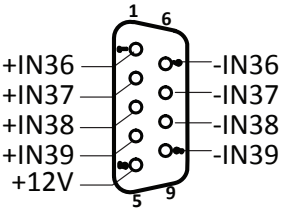
**RS422 Digital IN 0-3**

| DB9F Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +CH32 IN | 6 | -CH32 IN |
| 2 | +CH33 IN | 7 | -CH33 IN |
| 3 | +CH34 IN | 8 | -CH34 IN |
| 4 | +CH35 IN | 9 | -CH35 IN |
| 5 | +12V OUT | | |



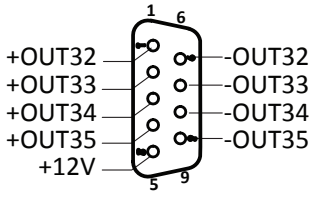

**RS422 Digital IN 4-7**

| DB9F Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +CH36 IN | 6 | -CH36 IN |
| 2 | +CH37 IN | 7 | -CH37 IN |
| 3 | +CH38 IN | 8 | -CH38 IN |
| 4 | +CH39 IN | 9 | -CH39 IN |
| 5 | +12V OUT | | |



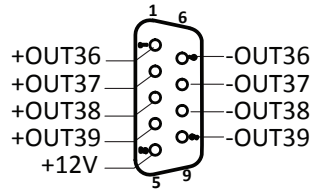

**RS422 Digital OUT 0-3**

| DB9 Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +CH32 OUT | 6 | -CH32 OUT |
| 2 | +CH33 OUT | 7 | -CH33 OUT |
| 3 | +CH34 OUT | 8 | -CH34 OUT |
| 4 | +CH35 OUT | 9 | -CH35 OUT |
| 5 | +12V OUT | | |




**RS422 Digital OUT 4-7**

| DB9 Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +CH36 OUT | 6 | -CH36 OUT |
| 2 | +CH37 OUT | 7 | -CH37 OUT |
| 3 | +CH38 OUT | 8 | -CH38 OUT |
| 4 | +CH39 OUT | 9 | -CH39 OUT |
| 5 | +12V OUT | | |



# SPECIFICATIONS

## OP4500 SIMULATOR SPECIFICATIONS

| **Product name** | **OP4500 RT-LAB-RCP/HIL SYSTEM** |
|---|---|
| Power supply | Universal input and active power factor correction 650W continuous power<br>DC to DC converters for analog voltage |
| I/O connectors | DB37F<br>DB9 |
| Number of SFP | 4 |
| SFP speed | 2 Gbps |
| Number of channels | 32 Dout or 24 Dout and 8 digital out RS422 (DB9)<br>32 Din or 24 Din and 8 digital in RS422 (DB9) |
| PC interface | Standard PC connectors (monitor, keyboard, mouse and network) |
| Dimensions (WxDxH) | 43.2 x 27.4 x 8.9cm (17” x 10.8” x 3.5”) |
| Weight | Approx. 1 Kg (2.2 lbs) |
| Operating temperature | 10 to 40 ºC (50 to 104ºF) |
| Storage temperature | -55 to 85ºC (-67 to 185ºF) |
| Relative humidity | 10 to 90% non-condensing |
| Maximum altitude | 2000 m (6562 ft.) |

# ON BOARD I/O SPECIFICATIONS

## 32 Digital In

| | |
|---|---|
| Number of channels | 32 digital inputs |
| Isolation | Optical isolator |
| Connection mode | Anode and cathode available on connector |
| Input current | 4.7 mA, current limiting diode |
| Reverse voltage protection | Schottky diode |
| Maximum reverse voltage protection | 30 Volts |
| Detection threshold | Separate Schmitt Trigger |
| Voltage range | < 0.8 V for low logic<br>4.2 to 30 V for high logic |

## 32 Digital Out

| | |
|---|---|
| Number of channels | 32 digital outputs |
| Isolation | Galvanic isolator |
| Output Protection | 50 mA resettable fuse |
| Protection thresholds | Under voltage: 4.85 V<br>Over voltage: 18.1 V<br>Reverse voltage: maximum 35 V. |
| Output Voltage range | 5 to 15 Vdc |
| Output configuration | Push-pull |
| Delay Low-to-High | <=50 ns |
| Delay High-to-Low | <=50 ns |
| Rise/Fall times | <= 15 ns |
| Power Isolation | On-board DC to DC isolated converter |

## RS422 Digital In

| | |
|---|---|
| Number of channels | 8 differential inputs |
| Isolation | Optical isolator |
| Detection threshold | ± 0.2 V (for ± 7 V range)<br>± 0.5 V (for ± 15 V range) |
| Input current | ± 3 mA |
| Voltage range | 5 to 15 Vdc |
| Delay Low-to-High | 65 ns |

## RS422 Digital Out

| | |
|---|---|
| Number of channels | 8 differential outputs |
| Isolation | Galvanic isolator |
| High level (With load)<br>Low level (With load) | 2.5 V min @ -20 mA<br>0.5 V max @ 20 mA |
| Voltage range | 5 to 15 Vdc |
| Delay Low-to-High | 55 ns |

# OP4500 SERIES PIN ASSIGNMENTS

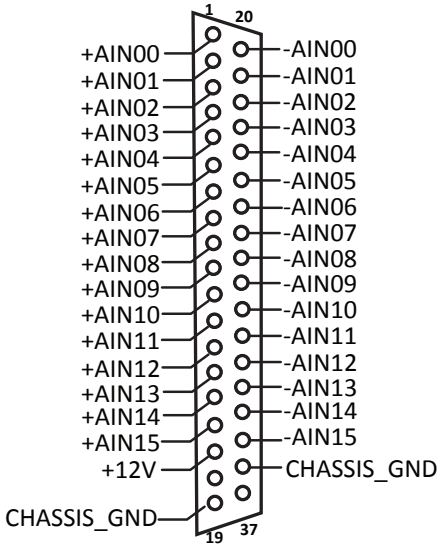
Because the OP4500 is available in different configurations (Series), the pin assignments vary according to the series option selected. The following tables provide details, including bitstream details, for each of the available series.

## OP4500 SERIES 100 FOR MECHATRONICS

| I/O Bitstream | I/O Configuration |
|---|---|
| OP4500_1-EX-0000-2_2_1_321-SERIES100_1-1-01.bin | • 16 Static Digital Inputs and Outputs<br>• 8 Pulse-Width Modulated Digital inputs and outputs<br>• 2 Differential Encoder inputs and outputs<br>• 2 Differential Pulse-Width Modulated digital inputs and outputs<br>• 16 Analog Inputs and Outputs |

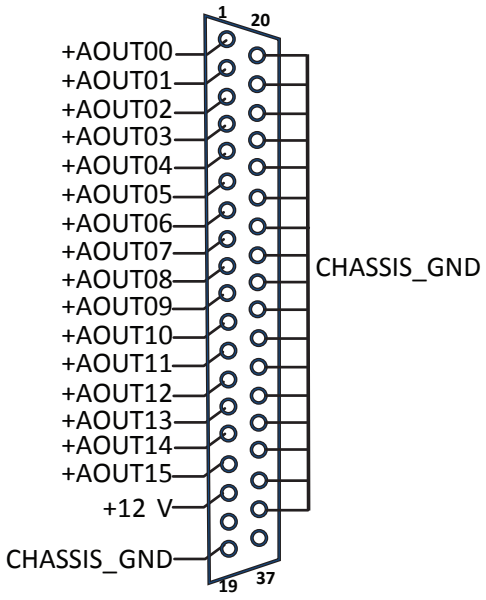
### SERIES 100 - ANALOG IN 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin assignment |
|---|---|---|---|
| 1 | +AIN00 | 20 | -AIN00 |
| 2 | +AIN01 | 21 | -AIN01 |
| 3 | +AIN02 | 22 | -AIN02 |
| 4 | +AIN03 | 23 | -AIN03 |
| 5 | +AIN04 | 24 | -AIN04 |
| 6 | +AIN05 | 25 | -AIN05 |
| 7 | +AIN06 | 26 | -AIN06 |
| 8 | +AIN07 | 27 | -AIN07 |
| 9 | +AIN08 | 28 | -AIN08 |
| 10 | +AIN09 | 29 | -AIN09 |
| 11 | +AIN10 | 30 | -AIN10 |
| 12 | +AIN11 | 31 | -AIN11 |
| 13 | +AIN12 | 32 | -AIN12 |
| 14 | +AIN13 | 33 | -AIN13 |
| 15 | +AIN14 | 34 | -AIN14 |
| 16 | +AIN15 | 35 | -AIN15 |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



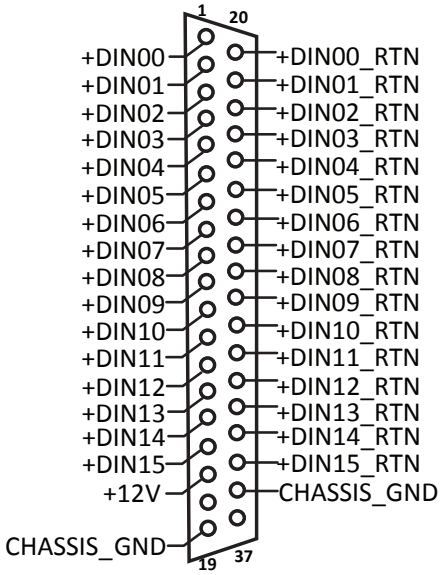
## SERIES 100 - ANALOG OUT 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin assignment |
|---|---|---|---|
| 1 | +AOUT00 | 20 | CHASSIS_GND |
| 2 | +AOUT01 | 21 | CHASSIS_GND |
| 3 | +AOUT02 | 22 | CHASSIS_GND |
| 4 | +AOUT03 | 23 | CHASSIS_GND |
| 5 | +AOUT04 | 24 | CHASSIS_GND |
| 6 | +AOUT05 | 25 | CHASSIS_GND |
| 7 | +AOUT06 | 26 | CHASSIS_GND |
| 8 | +AOUT07 | 27 | CHASSIS_GND |
| 9 | +AOUT08 | 28 | CHASSIS_GND |
| 10 | +AOUT09 | 29 | CHASSIS_GND |
| 11 | +AOUT10 | 30 | CHASSIS_GND |
| 12 | +AOUT11 | 31 | CHASSIS_GND |
| 13 | +AOUT12 | 32 | CHASSIS_GND |
| 14 | +AOUT13 | 33 | CHASSIS_GND |
| 15 | +AOUT14 | 34 | CHASSIS_GND |
| 16 | +AOUT15 | 35 | CHASSIS_GND |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



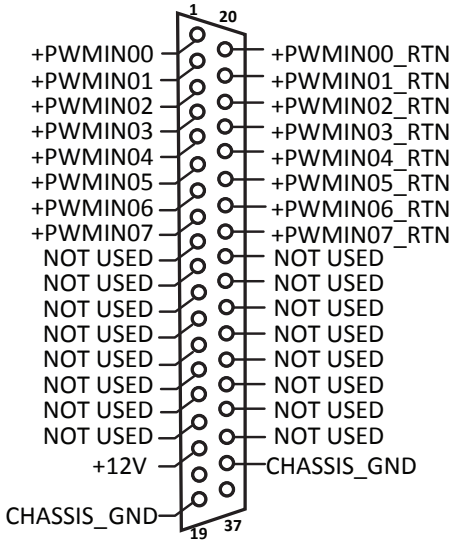
## SERIES 100 - DIGITAL IN 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin assignment |
|---|---|---|---|
| 1 | +DIN00 | 20 | +DIN00_RTN |
| 2 | +DIN01 | 21 | +DIN01_RTN |
| 3 | +DIN02 | 22 | +DIN02_RTN |
| 4 | +DIN03 | 23 | +DIN03_RTN |
| 5 | +DIN04 | 24 | +DIN04_RTN |
| 6 | +DIN05 | 25 | +DIN05_RTN |
| 7 | +DIN06 | 26 | +DIN06_RTN |
| 8 | +DIN07 | 27 | +DIN07_RTN |
| 9 | +DIN08 | 28 | +DIN08_RTN |
| 10 | +DIN09 | 29 | +DIN09_RTN |
| 11 | +DIN10 | 30 | +DIN10_RTN |
| 12 | +DIN11 | 31 | +DIN11_RTN |
| 13 | +DIN12 | 32 | +DIN12_RTN |
| 14 | +DIN13 | 33 | +DIN13_RTN |
| 15 | +DIN14 | 34 | +DIN14_RTN |
| 16 | +DIN15 | 35 | +DIN15_RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



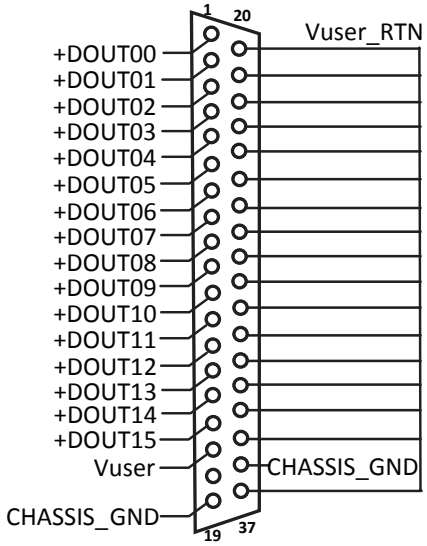
## SERIES 100 - DIGITAL IN 16-31 DB37

| DB37 | Module pin assignment | DB37 | Module pin assignment |
|---|---|---|---|
| 1 | +PWMIN00 | 20 | -PWMIN00_RTN |
| 2 | +PWMIN01 | 21 | -PWMIN01_RTN |
| 3 | +PWMIN02 | 22 | -PWMIN02_RTN |
| 4 | +PWMIN03 | 23 | -PWMIN03_RTN |
| 5 | +PWMIN04 | 24 | -PWMIN04_RTN |
| 6 | +PWMIN05 | 25 | -PWMIN05_RTN |
| 7 | +PWMIN06 | 26 | -PWMIN06_RTN |
| 8 | +PWMIN07 | 27 | -PWMIN07_RTN |
| 9 | NOT USED | 28 | NOT USED |
| 10 | NOT USED | 29 | NOT USED |
| 11 | NOT USED | 30 | NOT USED |
| 12 | NOT USED | 31 | NOT USED |
| 13 | NOT USED | 32 | NOT USED |
| 14 | NOT USED | 33 | NOT USED |
| 15 | NOT USED | 34 | NOT USED |
| 16 | NOT USED | 35 | NOT USED |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



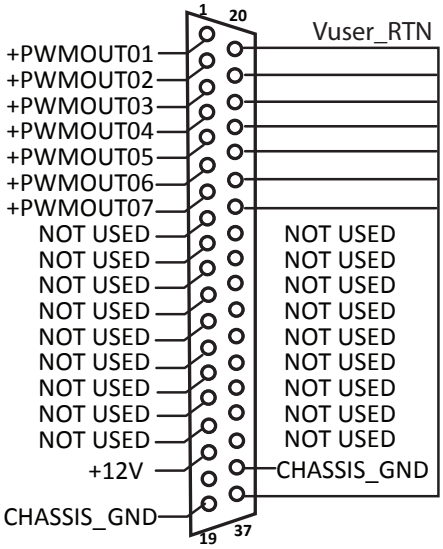
## SERIES 100 - DIGITAL OUT 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin assignment |
|---|---|---|---|
| 1 | +DOUT00 | 20 | Vuser_RTN |
| 2 | +DOUT01 | 21 | Vuser_RTN |
| 3 | +DOUT02 | 22 | Vuser_RTN |
| 4 | +DOUT03 | 23 | Vuser_RTN |
| 5 | +DOUT04 | 24 | Vuser_RTN |
| 6 | +DOUT05 | 25 | Vuser_RTN |
| 7 | +DOUT06 | 26 | Vuser_RTN |
| 8 | +DOUT07 | 27 | Vuser_RTN |
| 9 | +DOUT08 | 28 | Vuser_RTN |
| 10 | +DOUT09 | 29 | Vuser_RTN |
| 11 | +DOUT10 | 30 | Vuser_RTN |
| 12 | +DOUT11 | 31 | Vuser_RTN |
| 13 | +DOUT12 | 32 | Vuser_RTN |
| 14 | +DOUT13 | 33 | Vuser_RTN |
| 15 | +DOUT14 | 34 | Vuser_RTN |
| 16 | +DOUT15 | 35 | Vuser_RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | Vuser | 37 | Vuser_RTN |
| 19 | CHASSIS_GND | | |



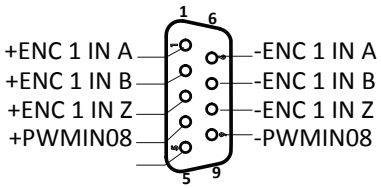
## SERIES 100 - DIGITAL OUT 16-31 DB37

| DB37 | Module pin assignment | DB37 | Module pin assignment |
|---|---|---|---|
| 1 | +PWMOUT00 | 20 | Vuser_RTN |
| 2 | +PWMOUT01 | 21 | Vuser_RTN |
| 3 | +PWMOUT02 | 22 | Vuser_RTN |
| 4 | +PWMOUT03 | 23 | Vuser_RTN |
| 5 | +PWMOUT04 | 24 | Vuser_RTN |
| 6 | +PWMOUT05 | 25 | Vuser_RTN |
| 7 | +PWMOUT06 | 26 | Vuser_RTN |
| 8 | +PWMOUT07 | 27 | Vuser_RTN |
| 9 | NOT USED | 28 | NOT USED |
| 10 | NOT USED | 29 | NOT USED |
| 11 | NOT USED | 30 | NOT USED |
| 12 | NOT USED | 31 | NOT USED |
| 13 | NOT USED | 32 | NOT USED |
| 14 | NOT USED | 33 | NOT USED |
| 15 | NOT USED | 34 | NOT USED |
| 16 | NOT USED | 35 | NOT USED |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | Vuser | 37 | Vuser_RTN |
| 19 | CHASSIS_GND | | |



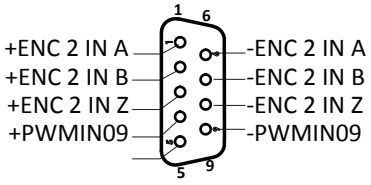

## RS422 Digital IN 0-3

| DB9F Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC1 IN A | 6 | -ENC1 IN A |
| 2 | +ENC1 IN B | 7 | -ENC1 IN B |
| 3 | +ENC1 IN Z | 8 | -ENC1 IN Z |
| 4 | +PWMIN08 | 9 | -PWMIN08 |
| 5 | | | |



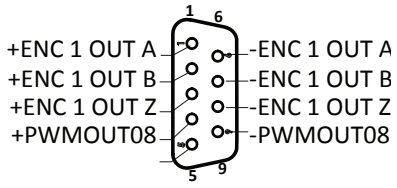

## RS422 Digital IN 4-7

| DB9F Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC2 IN A | 6 | -ENC2 IN A |
| 2 | +ENC2 IN B | 7 | -ENC2 IN B |
| 3 | +ENC2 IN Z | 8 | -ENC2 IN Z |
| 4 | +PWMIN09 | 9 | -PWMIN09 |
| 5 | | | |



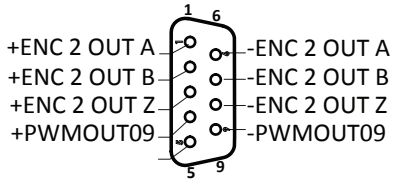
## RS422 Digital OUT 0-3

| DB9 Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC1 OUT A | 6 | -ENC1 OUT A |
| 2 | +ENC1 OUT B | 7 | -ENC1 OUT B |
| 3 | +ENC1 OUT Z | 8 | -ENC1 OUT Z |
| 4 | +PWMOUT08 | 9 | -PWMOUT08 |
| 5 | | | |




## RS422 Digital OUT 4-7

| DB9 Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC2 OUT A | 6 | -ENC2 OUT A |
| 2 | +ENC2 OUT B | 7 | -ENC2 OUT B |
| 3 | +ENC2 OUT Z | 8 | -ENC2 OUT Z |
| 4 | +PWMOUT09 | 9 | -PWMOUT09 |
| 5 | | | |




The OP4500 firmware can drive a maximum of 32 digital input and 32 digital output channels at one time. Two configurations are available:

1) CH 00 to 31 active; CH 32 to 39 inactive
2) CH 00 to 23 and CH 32 to 39 active: CH24 to 31 inactive

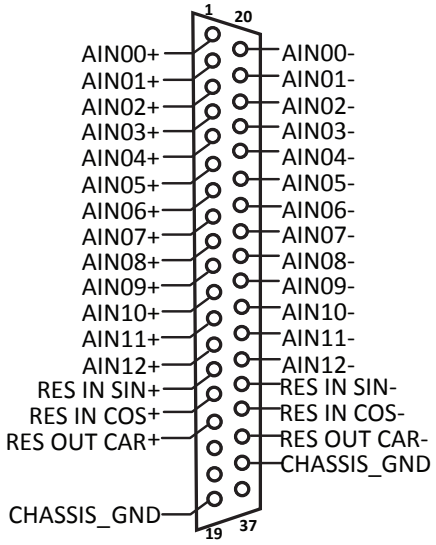
Input and output lines do not need to function in the same configuration: input lines can function in one configuration while output lines function in another configuration. (ex.: users can use channels 00 to 23 and 32 to 39 for digital output lines or vice versa).

# SERIES 200 FOR RCP

| I/O Bitstream | I/O Configuration |
|---|---|
| OP4500_1-EX-0000-2_2_1_321-SERIES200_1-2-01.bin | • 16 Time stamped digital inputs and outputs<br>• 8 Pulse-width modulated digital inputs and outputs<br>• 2 Differential encoder inputs and outputs<br>• 2 Differential pulse-width modulated digital inputs and outputs<br>• 13 Analog inputs and outputs<br>• 1 Resolver input and output |

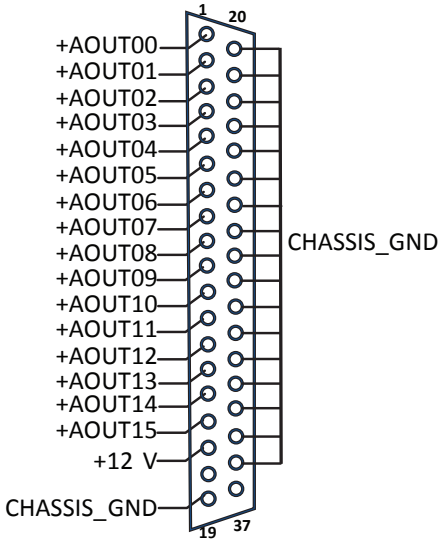
## SERIES 200 - ANALOG IN 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +AIN00 | 20 | -AIN00 |
| 2 | +AIN01 | 21 | -AIN01 |
| 3 | +AIN02 | 22 | -AIN02 |
| 4 | +AIN03 | 23 | -AIN03 |
| 5 | +AIN04 | 24 | -AIN04 |
| 6 | +AIN05 | 25 | -AIN05 |
| 7 | +AIN06 | 26 | -AIN06 |
| 8 | +AIN07 | 27 | -AIN07 |
| 9 | +AIN08 | 28 | -AIN08 |
| 10 | +AIN09 | 29 | -AIN09 |
| 11 | +AIN10 | 30 | -AIN10 |
| 12 | +AIN11 | 31 | -AIN11 |
| 13 | +AIN12 | 32 | -AIN12 |
| 14 | RES IN SINE+ | 33 | RES IN SINE- |
| 15 | RES IN COS+ | 34 | RES IN COS- |
| 16 | RES OUT CARRIER+ | 35 | RES OUT CARRIER- |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



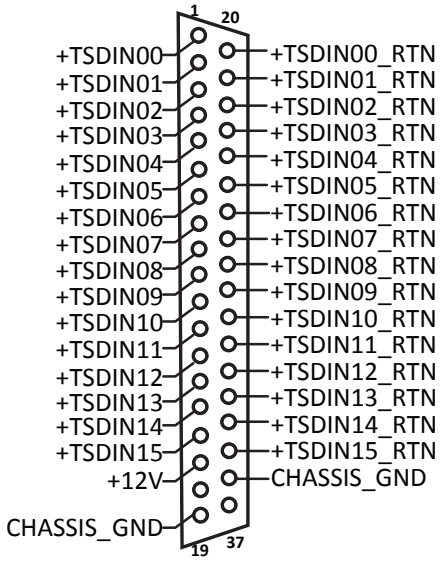
## SERIES 200 - ANALOG OUT 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +AOUT00 | 20 | CHASSIS_GND |
| 2 | +AOUT01 | 21 | CHASSIS_GND |
| 3 | +AOUT02 | 22 | CHASSIS_GND |
| 4 | +AOUT03 | 23 | CHASSIS_GND |
| 5 | +AOUT04 | 24 | CHASSIS_GND |
| 6 | +AOUT05 | 25 | CHASSIS_GND |
| 7 | +AOUT06 | 26 | CHASSIS_GND |
| 8 | +AOUT07 | 27 | CHASSIS_GND |
| 9 | +AOUT08 | 28 | CHASSIS_GND |
| 10 | +AOUT09 | 29 | CHASSIS_GND |
| 11 | +AOUT10 | 30 | CHASSIS_GND |
| 12 | +AOUT11 | 31 | CHASSIS_GND |
| 13 | +AOUT12 | 32 | CHASSIS_GND |
| 14 | +AOUT13 | 33 | CHASSIS_GND |
| 15 | +AOUT14 | 34 | CHASSIS_GND |
| 16 | +AOUT15 | 35 | CHASSIS_GND |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



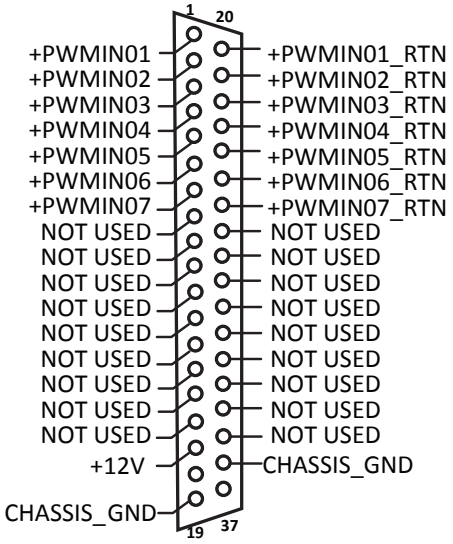
## SERIES 200 - DIGITAL IN 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +TSDIN00 | 20 | +TSDIN00 _RTN |
| 2 | +TSDIN01 | 21 | +TSDIN01 _RTN |
| 3 | +TSDIN02 | 22 | +TSDIN02 _RTN |
| 4 | +TSDIN03 | 23 | +TSDIN03 _RTN |
| 5 | +TSDIN04 | 24 | +TSDIN04 _RTN |
| 6 | +TSDIN05 | 25 | +TSDIN05 _RTN |
| 7 | +TSDIN06 | 26 | +TSDIN06 _RTN |
| 8 | +TSDIN07 | 27 | +TSDIN07 _RTN |
| 9 | +TSDIN08 | 28 | +TSDIN08 _RTN |
| 10 | +TSDIN09 | 29 | +TSDIN09 _RTN |
| 11 | +TSDIN10 | 30 | +TSDIN10 _RTN |
| 12 | +TSDIN11 | 31 | +TSDIN11 _RTN |
| 13 | +TSDIN12 | 32 | +TSDIN12 _RTN |
| 14 | +TSDIN13 | 33 | +TSDIN13 _RTN |
| 15 | +TSDIN14 | 34 | +TSDIN14 _RTN |
| 16 | + TSDIN15 | 35 | +TSDIN15 _RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



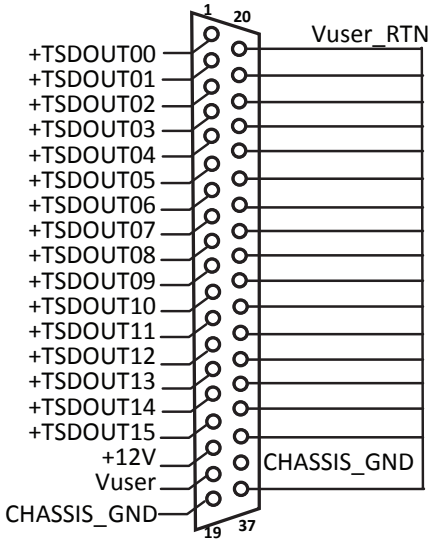
## SERIES 200 - DIGITAL IN 16-31 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +PWMIN00 | 20 | +PWMIN00 _RTN |
| 2 | +PWMIN01 | 21 | +PWMIN01 _RTN |
| 3 | +PWMIN02 | 22 | +PWMIN02 _RTN |
| 4 | +PWMIN03 | 23 | +PWMIN03 _RTN |
| 5 | +PWMIN04 | 24 | +PWMIN04 _RTN |
| 6 | +PWMIN05 | 25 | +PWMIN05 _RTN |
| 7 | +PWMIN06 | 26 | +PWMIN06 _RTN |
| 8 | +PWMIN07 | 27 | +PWMIN07 _RTN |
| 9 | NOT USED | 28 | NOT USED |
| 10 | NOT USED | 29 | NOT USED |
| 11 | NOT USED | 30 | NOT USED |
| 12 | NOT USED | 31 | NOT USED |
| 13 | NOT USED | 32 | NOT USED |
| 14 | NOT USED | 33 | NOT USED |
| 15 | NOT USED | 34 | NOT USED |
| 16 | NOT USED | 35 | NOT USED |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



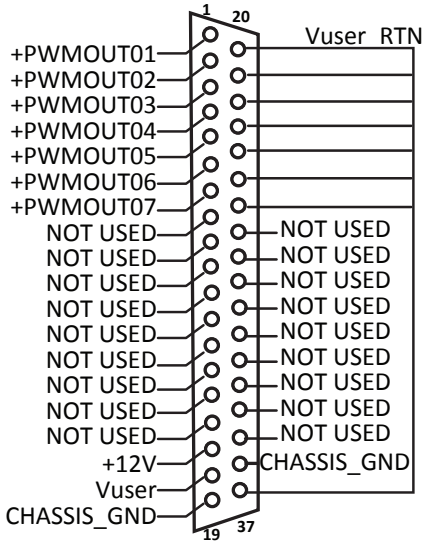
## SERIES 200 - DIGITAL OUT 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +TSDOUT00 | 20 | Vuser_RTN |
| 2 | +TSDOUT01 | 21 | Vuser_RTN |
| 3 | +TSDOUT02 | 22 | Vuser_RTN |
| 4 | +TSDOUT03 | 23 | Vuser_RTN |
| 5 | +TSDOUT04 | 24 | Vuser_RTN |
| 6 | +TSDOUT05 | 25 | Vuser_RTN |
| 7 | +TSDOUT06 | 26 | Vuser_RTN |
| 8 | +TSDOUT07 | 27 | Vuser_RTN |
| 9 | +TSDOUT08 | 28 | Vuser_RTN |
| 10 | +TSDOUT09 | 29 | Vuser_RTN |
| 11 | +TSDOUT10 | 30 | Vuser_RTN |
| 12 | +TSDOUT11 | 31 | Vuser_RTN |
| 13 | +TSDOUT12 | 32 | Vuser_RTN |
| 14 | +TSDOUT13 | 33 | Vuser_RTN |
| 15 | +TSDOUT14 | 34 | Vuser_RTN |
| 16 | + TSDOUT15 | 35 | Vuser_RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | Vuser | 37 | Vuser_RTN |
| 19 | CHASSIS_GND | | |



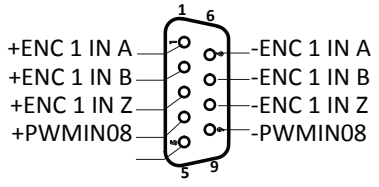
## SERIES 200 - DIGITAL OUT 16-31 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +PWMOUT00 | 20 | Vuser_RTN |
| 2 | +PWMOUT01 | 21 | Vuser_RTN |
| 3 | +PWMOUT02 | 22 | Vuser_RTN |
| 4 | +PWMOUT03 | 23 | Vuser_RTN |
| 5 | +PWMOUT04 | 24 | Vuser_RTN |
| 6 | +PWMOUT05 | 25 | Vuser_RTN |
| 7 | +PWMOUT06 | 26 | Vuser_RTN |
| 8 | +PWMOUT07 | 27 | Vuser_RTN |
| 9 | NOT USED | 28 | NOT USED |
| 10 | NOT USED | 29 | NOT USED |
| 11 | NOT USED | 30 | NOT USED |
| 12 | NOT USED | 31 | NOT USED |
| 13 | NOT USED | 32 | NOT USED |
| 14 | NOT USED | 33 | NOT USED |
| 15 | NOT USED | 34 | NOT USED |
| 16 | NOT USED | 35 | NOT USED |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | Vuser | 37 | Vuser_RTN |
| 19 | CHASSIS_GND | | |



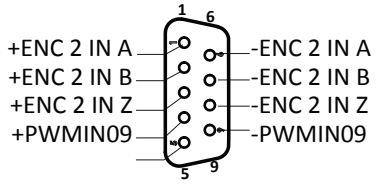
## RS422 Digital IN 0-3

| DB9F Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC 1 IN A | 6 | -ENC 1 IN A |
| 2 | +ENC 1 IN B | 7 | -ENC 1 IN B |
| 3 | +ENC 1 IN Z | 8 | -ENC 1 IN Z |
| 4 | +PWMIN08 | 9 | -PWMIN08 |
| 5 | | | |



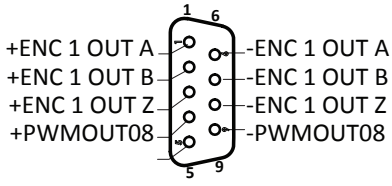

## RS422 Digital IN 4-7

| DB9F Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC 2 IN A | 6 | -ENC 2 IN A |
| 2 | +ENC 2 IN B | 7 | -ENC 2 IN B |
| 3 | +ENC 2 IN Z | 8 | -ENC 2 IN Z |
| 4 | +PWMIN08 | 9 | -PWMIN08 |
| 5 | | | |



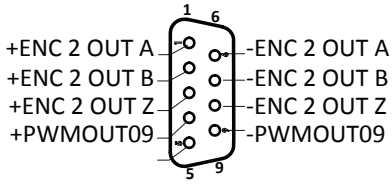

## RS422 Digital OUT 0-3

| DB9 Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC 1 OUT A | 6 | -ENC 1 OUT A |
| 2 | +ENC 1 OUT B | 7 | -ENC 1 OUT B |
| 3 | +ENC 1 OUT Z | 8 | -ENC 1 OUT Z |
| 4 | +PWMOUT08 | 9 | -PWMOUT08 |
| 5 | | | |




## RS422 Digital OUT 4-7

| DB9 Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC 2 OUT A | 6 | -ENC 2 OUT A |
| 2 | +ENC 2 OUT B | 7 | -ENC 2 OUT B |
| 3 | +ENC 2 OUT Z | 8 | -ENC 2 OUT Z |
| 4 | +PWMOUT09 | 9 | -PWMOUT09 |
| 5 | | | |

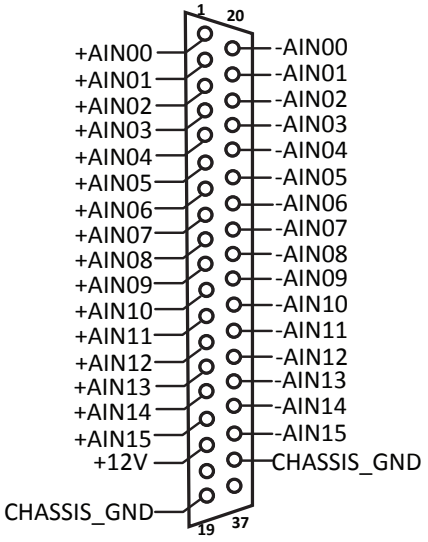


# OP4500 SERIES 300 AND 400 FOR POWER ELECTRONICS

| I/O Bitstream | I/O Configuration |
|---|---|
| OP4500_1-EX-0000-2_2_1_321-SERIES300_1-3-01.bin | • 16 Time-stamped digital inputs and outputs<br>• 8 Pulse-width modulated digital inputs and outputs<br>• 8 Differential pulse-width modulated digital inputs and outputs<br>• 16 Analog inputs and outputs |

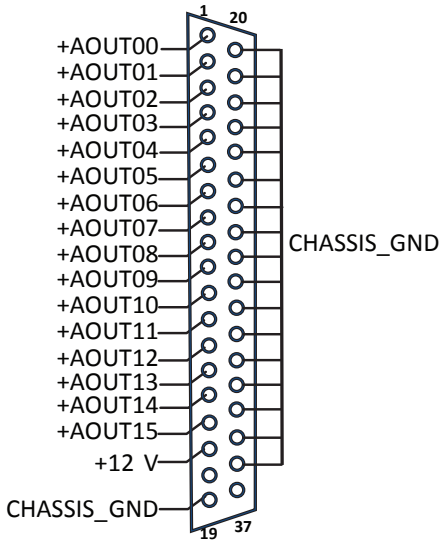
## SERIES 300/400 - ANALOG IN 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +AIN00 | 20 | -AIN00 |
| 2 | +AIN01 | 21 | -AIN01 |
| 3 | +AIN02 | 22 | -AIN02 |
| 4 | +AIN03 | 23 | -AIN03 |
| 5 | +AIN04 | 24 | -AIN04 |
| 6 | +AIN05 | 25 | -AIN05 |
| 7 | +AIN06 | 26 | -AIN06 |
| 8 | +AIN07 | 27 | -AIN07 |
| 9 | +AIN08 | 28 | -AIN08 |
| 10 | +AIN09 | 29 | -AIN09 |
| 11 | +AIN10 | 30 | -AIN10 |
| 12 | +AIN11 | 31 | -AIN11 |
| 13 | +AIN12 | 32 | -AIN12 |
| 14 | +AIN13 | 33 | -AIN13 |
| 15 | +AIN14 | 34 | -AIN14 |
| 16 | +AIN15 | 35 | -AIN15 |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



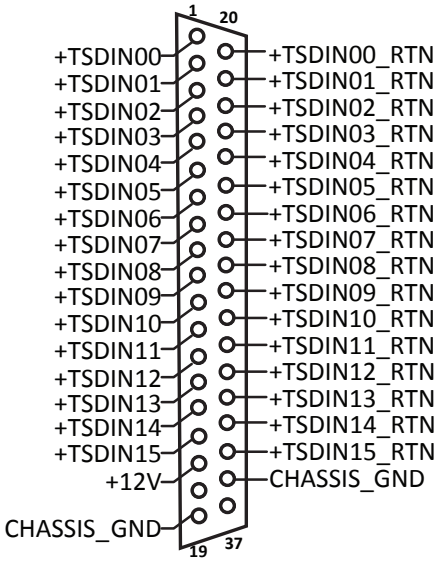
## SERIES 300/400 - ANALOG OUT 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +AOUT00 | 20 | CHASSIS_GND |
| 2 | +AOUT01 | 21 | CHASSIS_GND |
| 3 | +AOUT02 | 22 | CHASSIS_GND |
| 4 | +AOUT03 | 23 | CHASSIS_GND |
| 5 | +AOUT04 | 24 | CHASSIS_GND |
| 6 | +AOUT05 | 25 | CHASSIS_GND |
| 7 | +AOUT06 | 26 | CHASSIS_GND |
| 8 | +AOUT07 | 27 | CHASSIS_GND |
| 9 | +AOUT08 | 28 | CHASSIS_GND |
| 10 | +AOUT09 | 29 | CHASSIS_GND |
| 11 | +AOUT10 | 30 | CHASSIS_GND |
| 12 | +AOUT11 | 31 | CHASSIS_GND |
| 13 | +AOUT12 | 32 | CHASSIS_GND |
| 14 | +AOUT13 | 33 | CHASSIS_GND |
| 15 | +AOUT14 | 34 | CHASSIS_GND |
| 16 | +AOUT15 | 35 | CHASSIS_GND |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



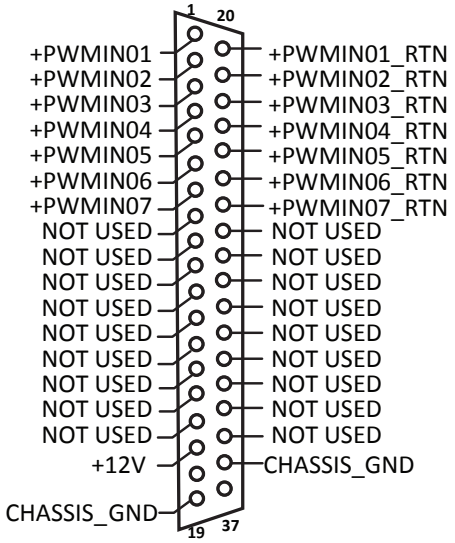
## SERIES 300/400 - DIGITAL IN 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +TSDIN00 | 20 | -TSDIN00 |
| 2 | +TSDIN01 | 21 | -TSDIN01 |
| 3 | +TSDIN02 | 22 | -TSDIN02 |
| 4 | +TSDIN03 | 23 | -TSDIN03 |
| 5 | +TSDIN04 | 24 | -TSDIN04 |
| 6 | +TSDIN05 | 25 | -TSDIN05 |
| 7 | +TSDIN06 | 26 | -TSDIN06 |
| 8 | +TSDIN07 | 27 | -TSDIN07 |
| 9 | +TSDIN08 | 28 | -TSDIN08 |
| 10 | +TSDIN09 | 29 | -TSDIN09 |
| 11 | +TSDIN10 | 30 | -TSDIN10 |
| 12 | +TSDIN11 | 31 | -TSDIN11 |
| 13 | +TSDIN12 | 32 | -TSDIN12 |
| 14 | +TSDIN13 | 33 | -TSDIN13 |
| 15 | +TSDIN14 | 34 | -TSDIN14 |
| 16 | + TSDIN15 | 35 | -TSDIN15 |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



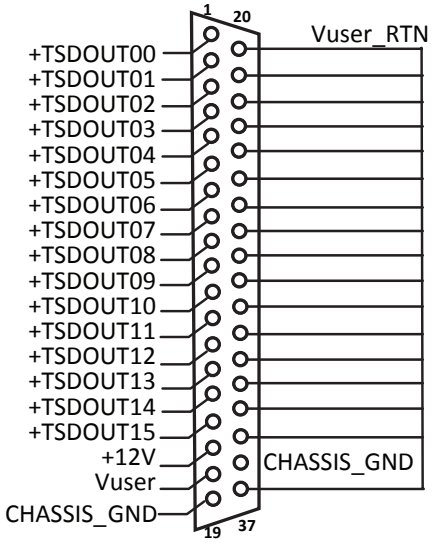
## SERIES 300/400 - DIGITAL IN 16-31 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +PWMIN00 | 20 | -PWMIN00 |
| 2 | +PWMIN01 | 21 | -PWMIN01 |
| 3 | +PWMIN02 | 22 | -PWMIN02 |
| 4 | +PWMIN03 | 23 | -PWMIN03 |
| 5 | +PWMIN04 | 24 | -PWMIN04 |
| 6 | +PWMIN05 | 25 | -PWMIN05 |
| 7 | +PWMIN06 | 26 | -PWMIN06 |
| 8 | +PWMIN07 | 27 | -PWMIN07 |
| 9 | NOT USED | 28 | NOT USED |
| 10 | NOT USED | 29 | NOT USED |
| 11 | NOT USED | 30 | NOT USED |
| 12 | NOT USED | 31 | NOT USED |
| 13 | NOT USED | 32 | NOT USED |
| 14 | NOT USED | 33 | NOT USED |
| 15 | NOT USED | 34 | NOT USED |
| 16 | NOT USED | 35 | NOT USED |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | | 37 | |
| 19 | CHASSIS_GND | | |



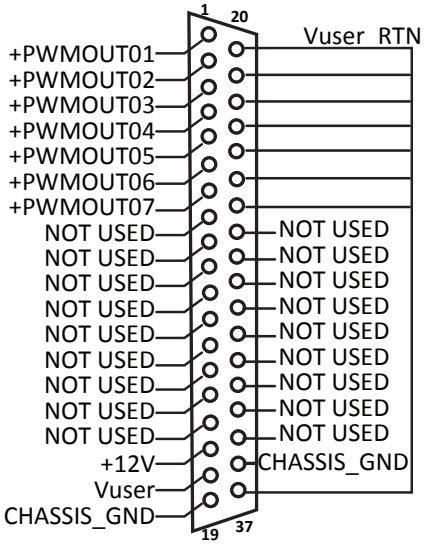
## SERIES 300/400 - DIGITAL OUT 0-15 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +TSDOUT00 | 20 | Vuser_RTN |
| 2 | +TSDOUT01 | 21 | Vuser_RTN |
| 3 | +TSDOUT02 | 22 | Vuser_RTN |
| 4 | +TSDOUT03 | 23 | Vuser_RTN |
| 5 | +TSDOUT04 | 24 | Vuser_RTN |
| 6 | +TSDOUT05 | 25 | Vuser_RTN |
| 7 | +TSDOUT06 | 26 | Vuser_RTN |
| 8 | +TSDOUT07 | 27 | Vuser_RTN |
| 9 | +TSDOUT08 | 28 | Vuser_RTN |
| 10 | +TSDOUT09 | 29 | Vuser_RTN |
| 11 | +TSDOUT10 | 30 | Vuser_RTN |
| 12 | +TSDOUT11 | 31 | Vuser_RTN |
| 13 | +TSDOUT12 | 32 | Vuser_RTN |
| 14 | +TSDOUT13 | 33 | Vuser_RTN |
| 15 | +TSDOUT14 | 34 | Vuser_RTN |
| 16 | + TSDOUT15 | 35 | Vuser_RTN |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | Vuser | 37 | Vuser_RTN |
| 19 | CHASSIS_GND | | |



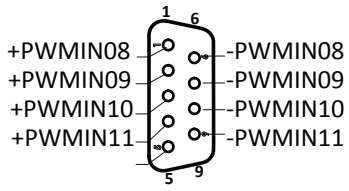
## SERIES 300/400 - DIGITAL OUT 16-31 DB37

| DB37 | Module pin assignment | DB37 | Module pin Assignment |
|---|---|---|---|
| 1 | +PWMOUT00 | 20 | Vuser_RTN |
| 2 | +PWMOUT01 | 21 | Vuser_RTN |
| 3 | +PWMOUT02 | 22 | Vuser_RTN |
| 4 | +PWMOUT03 | 23 | Vuser_RTN |
| 5 | +PWMOUT04 | 24 | Vuser_RTN |
| 6 | +PWMOUT05 | 25 | Vuser_RTN |
| 7 | +PWMOUT06 | 26 | Vuser_RTN |
| 8 | +PWMOUT07 | 27 | Vuser_RTN |
| 9 | NOT USED | 28 | NOT USED |
| 10 | NOT USED | 29 | NOT USED |
| 11 | NOT USED | 30 | NOT USED |
| 12 | NOT USED | 31 | NOT USED |
| 13 | NOT USED | 32 | NOT USED |
| 14 | NOT USED | 33 | NOT USED |
| 15 | NOT USED | 34 | NOT USED |
| 16 | NOT USED | 35 | NOT USED |
| 17 | +12V | 36 | CHASSIS_GND |
| 18 | Vuser | 37 | Vuser_RTN |
| 19 | CHASSIS_GND | | |



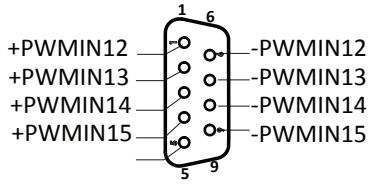
## RS422 Digital IN 0-3

| DB9F Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC1 IN A | 6 | -ENC1 IN A |
| 2 | +ENC1 IN B | 7 | -ENC1 IN B |
| 3 | +ENC1 IN Z | 8 | -ENC1 IN Z |
| 4 | +PWMIN08 | 9 | -PWMIN08 |
| 5 | | | |



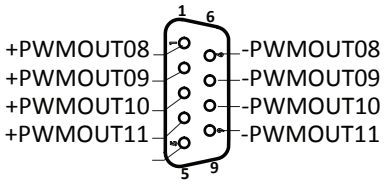

## RS422 Digital IN 4-7

| DB9F Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +ENC2 IN A | 6 | -ENC2 IN A |
| 2 | +ENC2 IN B | 7 | -ENC2 IN B |
| 3 | +ENC2 IN Z | 8 | -ENC2 IN Z |
| 4 | +PWMIN09 | 9 | -PWMIN09 |
| 5 | | | |



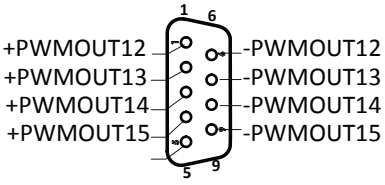

## RS422 Digital OUT 0-3

| DB9 Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +PWMIN08 | 6 | -PWMIN08 |
| 2 | +PWMIN09 | 7 | -PWMIN09 |
| 3 | +PWMIN10 | 8 | -PWMIN10 |
| 4 | +PWMIN11 | 9 | -PWMIN11 |
| 5 | | | |




## RS422 Digital OUT 4-7

| DB9 Pin | OP4500 pin assignment | DB9F Pin | OP4500 pin assignment |
|---|---|---|---|
| 1 | +PWMIN12 | 6 | -PWMIN12 |
| 2 | +PWMIN13 | 7 | -PWMIN13 |
| 3 | +PWMIN14 | 8 | -PWMIN14 |
| 4 | +PWMIN15 | 9 | -PWMIN15 |
| 5 | | | |



# LIMITED WARRANTY

## limited warranty

OPAL-RT Technologies Inc. warrants to the original purchaser and/or ultimate customer (“Purchaser”) of OPAL-RT products (“Product”) that if any part thereof proves to be defective in material or workmanship within one (1) year, such defective part will be repaired or replaced, free of charge, at OPAL-RT Technologies’ discretion, if shipped prepaid to OPAL-RT Technologies Inc. at 1751 Richardson, suite 2525, Montreal, Quebec, Canada, H3K 3G6, in a package equal to or in the original container. The Product will be returned freight prepaid and repaired or replaced if it is determined by OPAL-RT Technologies Inc. that the part failed due to defective materials or workmanship. Otherwise, the fees will be charged to the client (see article “warranty limitation and exclusion”). The repair or replacement of any such defective part shall be OPAL-RT Technologies’ sole and exclusive responsibility and liability under this limited warranty.

Purchaser must request an RMA number before shipping any Product for repair:

1. Access the OPAL-RT website (www.opal-rt.com/support/ return-merchandise-authorization-rma-request), click on support and select Return Merchandise (RMA).
2. Fill out the online form and submit.
3. OPAL-RT’s Support department will evalute the return and either issue an RMA number via email
   - If the Product is returned for repair more than 12 months after purchase, the Purchaser is responsible for the cost of repair. OPAL-RT will assess the repair and prepare a quote. The RMA number will be sent with the quote.
4. Only when the Purchaser receives the RMA number, may they ship the Product, prepaid, to OPAL-RT.

## return policy

the following fees will apply when customers return products for credit:

A full credit, less a 15% fee and less return fee will only be issued if the product is in perfect working condition and if the product is returned within 1 month following the shipping date. If repairs are required on the returned product, the cost of these repairs will be deducted from the credit to be issued.

No credits will be issued beyond the one month period.

## exclusions

If third party products are part of the Product, OPAL-RT will honor the original manufacturer’s warranty.

This limited warranty does not cover consumable items, such as batteries, or items subject to wear or periodic replacement, including lamps, fuses or filter elements.

## warranty limitation and exclusion

OPAL-RT Technologies will have no further obligation under this limited warranty. All warranty obligations of OPAL-RT Technologies are void if the Product has been subject to abuse, misuse, negligence, or accident or if the Purchaser fails to perform any of the duties set forth in this limited warranty or if the Product has not been operated in accordance with instructions, or if the Product serial number has been removed or altered.

## disclaimer of unstated warranties

The warranty printed above is the only warranty applicable to this purchase. All other warranties, express or implied, including, but not limited to, the implied warranties of merchantability or fitness for a particular purpose are hereby disclaimed.

## limitation of liability

It is understood and agreed that OPAL-RT Technologies' liability, whether in contract, in tort, under any warranty, in negligence or otherwise shall not exceed the amount of the purchase price paid by the purchaser for the product and under no circumstances shall OPAL-RT Technologies be liable for special, indirect, or consequential damages. The price stated for the product is a consideration limiting OPAL-RT Technologies' liability. No action, regardless of form, arising out of the transactions under this warranty may be brought by the purchaser more than one year after the cause of actions has occurred.

**CONTACT**

**OPAL-RT Corporate Headquarters**

1751 Richardson, Suite 2525
Montréal, Québec, Canada
H3K 1G6
Tel.: 514-935-2323
Toll free: 1-877-935-2323

**Technical Services**
www.opal-rt.com/support

**Note:**

**While every effort has been made to ensure accuracy in this publication, no responsibility can be accepted for errors or omissions. Data may change, as well as legislation, and you are strongly advised to obtain copies of the most recently issued regulations, standards, and guidelines.**
**This publication is not intended to form the basis of a contract.**

**UG 13-46319-OP1**
**11/2013**
**© Opal-RT Technologies Inc.**